

# **The International Space Station (ISS) Solar Alpha Rotary Joint (SARJ): Materials & Processes (M&P) Lessons Learned for a Large, Spacecraft Rotating Mechanism**

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## Abstract

The ISS utilizes two large rotating mechanisms, the SARJ, as part of the solar arrays alignment system for more efficient power generation. The SARJ is a 10.3m circumference, nitrided 15-5PH steel race ring of triangular cross-section, with 12 sets of trundle bearing assemblies transferring load across the rolling joint. The SARJ mechanism rotates continuously and slowly – once every orbit, or every 90 minutes. In 2008, the starboard SARJ suffered a lubrication failure, resulting in severe damage (spalling) of one of the race ring surfaces. Extensive effort was conducted to prevent the port SARJ from suffering the same failure, and fortunately was ultimately successful in recovering the functionality of the starboard SARJ. The M&P function was key in determining the cause of failure and the means for mechanism recovery.

From a M&P lessons-learned perspective, observations are made concerning the original SARJ design parameters (boundary conditions), the perceived need for nitriding the race ring, the test conditions employed during qualification, the environmental controls used for the hardware preflight, and the lubrication robustness necessary for complex kinematic mechanisms expecting high-reliability and long-life.